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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/773,796	VEERASAMY ET AL.
	Examiner	Art Unit
	MARIANNE L. PADGETT	1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 12/9/08, 8/5/08 & 8/4/2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 3-5,7-11,16-25,28-33,35,36 and 39 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 7-11,18,21 and 22 is/are allowed.

6)☒ Claim(s) 3-5,16,17,19,20,23-25,28,29,31-33,35 and 39 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 12/9/8, 8/5/8, 8/4/8.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

1. A **Request for Continued Examination** under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on **12/9/2008** has been entered.

The amendment to the claims submitted with the RCE request cancels claims 26-27, 30, 37-38 & 40, thus removing the 112, first paragraph rejections applied in sections 3-4 of the action mailed 8/5/2008.

Applicants' amendment to the specification, replacing TABLE II on page 27 appears to appropriately correct the fifth col. table caption, given the discussion found in paragraphs [0101] concerning Δ values describing peak width, [0102] & [0108] discussion of the peak bandwidth or G-peak widths, respectively, of similar values; plus the disclosure as originally filed in grand parent case 09/648,341 on page 25, lines 15-21 & table 2; or page 26, or great great grand parent 08/761,336 on page 32, lines 19-28 & table II, thereof (applicants' citation of tables on page 25 of provisional applications is noted & appreciated, however these provisional applications are not scanned in to the computer, hence not available to the examiner at this time for review, but given applicants' statement on the record & the disclosures of applications (341) & (336), the citation of support is considered sufficient).

2. **Claims 3-5, 16-17, 19-20, 23-25, 28-29, 31-33, 35 & 39** are rejected under **35 U.S.C. 112, second** paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

On review of independent **claims 3 & 31**, it is noted that the preamble, which requires the method to deposit "a coating comprising a continuous tetrahedral amorphous carbon on a substrate" is not commensurate in scope with the steps of the process in the body of the claim, which while depositing on the substrate, does not necessitate the formation of any "coating", nor that that coating comprise any "continuous tetrahedral amorphous carbon", hence exactly what results is intended to be required is

unclear. It is noted that while one of ordinary skill in art would consider the presence of sp^3 C-C bonds the equivalent of having at least some carbon in a tetrahedral bond structure, this necessitates neither continuous nor amorphous deposits or coatings. Also note that for purposes of clarity in the claims, consistent language, or other means to indicate the equivalence of different means of describing a limitation, preferably should be employed. Applicants should also note that "...promote formation of more than 15% sp^3 carbon-carbon bonds", while it **may** cause or lead to such bonds forming, does not actually necessitate their formation, since "promote formation" is not a positive requirement of forming such bonds, but an instigator that does not **necessitate** results.

3. The following is a quotation of **35 U.S.C. 103(a)** which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In*

re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. **Claims 3-4, 20, 23-24, 28-29** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Markunas et al.** (5,180,435).

Markunas et al. teach a remote plasma enhance CVD process for growing semiconductor layers, where one of the options include the use of methane gas to make diamond, graphite, amorphous or glassy carbon, or mixtures thereof dependent on growth conditions. Markunas et al. create a remote plasma & employed a filtering process, so as to limit the particular reactive plasma species present when carrier gas & deposition gas is input into the plasma stream directed at the substrate, such that the selected plasma species chemically interact, so as to dissociate & activate the deposition gas to produce desired limited precursor species. This activation includes ionization of the carbon source material, thus forming a plasma stream, which comprises carbon, reading on conditions required by the broadly stated process. For the particular example of employing methane, it is taught that the technique's selection of particular excited species of noble gas exemplified by He tuned to a particular energy, is employed to limit the produced excited precursor species, exemplified by producing CH_4^+, CH_3^+ or CH_3, all highly saturated CH_x radicals, which provide precursors for carbon-carbon bonding having sp^3 hybridization, and which are considered to read on the claimed "substantially uniform weight distribution", where the taught use of a "tuned energy" (e.g. 4-20 eV) is considered to sufficiently limit to create a limited range of energies in the excited species created from methane, such that it would've been obvious to one of ordinary skill in the art, that given the teaching that the particular carbon deposit structure of diamond, graphite, amorphous or glassy carbon or mixtures thereof is dependent on the growth conditions, to employ routine

experimentation to determine particular range of ion energies effective for producing particularly desired carbon coating microstructure, which would reasonably have been expected to include energy conditions that could be described as "substantially uniform impact energy distribution". In Markunas et al. particularly see, the abstract; figures, esp. fig. 2; summary, esp. col. 3, lines 25-45; col. 4, esp. lines 5-12, 20-35 & 64-68; col. 5, esp. lines 1-40; col. 6, lines 21-61; col. 7, line 67-col. 10, line 26, esp. col. 8, lines 1-63 and col. 9, lines 14 & 56; col. 12, lines 5-63 esp. 5-20 & table I.

Various growth rates for epitaxial diamond for different process alternatives are mentioned inclusive of approximately 2000 Å/hr (= 0.56Å/sec), or ≥ 1Å/sec, or ~7 Å/sec, thus while not explicitly mentioning carbon deposition rates higher than 10 Å per second, it would've been obvious to one of ordinary skill in the art that given specific deposition rates close to overlapping & open ended range inclusive of claimed values, that dependent on particular microstructure desired & particular remote plasma feed gases & configurations used to produce particular growth conditions, deposition rates overlapping with those claims would have been expected to have been effectively produced. While Markunas et al. do not use same measurements on their deposit carbon as applicants, so that the examiner cannot compare Raman G peak values, given the teachings of tetrahedral (sp^3) deposition, i.e. diamond, as well as amorphous carbons, etc., with the methane deposition gas been taught to supply sp^3 structure, one of ordinary skill in the art would reasonably have expected if Raman spectra measurements were made to a produced peak range values as claimed. Note dependent claims directed to "subplantation" have been included as the deposition process of Markunas et al. which produce sp^3 bonding would appear to be reasonably consistent with descriptions on record which provide descriptions of the "subplantation" model or mechanism of forming sp^3 bonded carbon structures.

5. **Claims 3-5, 16-17, 20, 23-30 & 37-38** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Baldwin et al.** (5,616,179), previously discussed in sections 12, 8, 7 & 7 of the actions mailed 3/29/2005, 11/16/2005, 7/21/06 (7/6/06) & 9/6/2007, respectively.

The declaration submitted 12/9/2008 of Dr. Manfred Weiler, concerning his opinion that the process described in Baldwin et al. (179), is different than that described in the instant application, where the examiner notes that difference from the application, does not necessarily relate to difference from the broad claims still under rejection. Dr. Weiler discusses the reliance on "end hall 'Kaufman Type' DC ion sources" as having a reliance on magnetic fields for controlling ion energy distribution in the plasma source, however this is completely irrelevant to the claimed process of independent claims 3 or 31 & their dependent claims, which neither require nor exclude the use of magnetic fields in any way, shape or form, and applicants' specification specifically employs a magnetic field, as can be seen in allowed independent claim 7. Furthermore, Baldwin at all discusses 2 types of ion sources, the "end-Hall ion source" (col. 4, lines 24-27 & 53-62; col. 5, lines 53-col. 6, lines 55; col. 9, lines 29-59; ref.#3 or 3' in figures 1-3), and the "Kaufman-type dual grid broad ion beam source" (col. 9, lines 18-28 & figure 2, ref. #4), hence the declaration's discussion lumping these two types of sources as a single ion source, makes it unclear how the declarations discussion relates to the actual disclosures of Baldwin et al. Of more relevance to claimed limitations, is the discussion concerning ion energy distribution being broad, because the potential of origin of the accelerated ions is not precisely define, citing previously discussed disclosures in Baldwin et al., but does not relate this discussion to what would be produced with the end-Hall ion source (or Kaufman ion beam source) that uses taught acetylene rather than exemplified methane, which weakens this point of the declaration with respect to the rejection, since acetylene would reasonably have been expected by one of ordinary skill in the art dependent on energy is employed to provide more defined mass distribution due to its chemical structure, which would in turn been expected to limit the

energy distribution, since unlike methane H ions are less likely to be produced, as is consistent with Baldwin et al.'s discussion on col. 6, lines 31-52.

Noting the literal meaning of "substantially uniform impact energy distribution and substantially uniform weight distribution from the plasma" could mean a stream of ions whose energy distribution & weight distribution does not very from one portion of the cross-section of the stream to another portion of the cross-section; or that "uniform" could be describing a characteristic of the energy's & weight's range distribution. It is noted that the Kaufman ion source of Baldwin et al. being described as a "broad beam ion source" (col. 9, lines 19-20) & the end-Hall ion source is described as having "broader area of beam coverage" (col. 5, lines 53 and 59), would have reasonably been expected to have a substantially uniform distribution of energy & weight across the breath of the beam, however the declaration's & applicant's arguments emphasis on "ion energy distribution contains low-energy ions and high energy [ions] of the beam" (actually said "component") indicates an intent to claim the latter (energy & weight range distribution), rather than energy & weight location distributions, which likely intent was also noted in the action mailed 1/4/2008 in the paragraph bridging pages 2-3, that notes specifications paragraphs [0060-64 & 68], disclosing ion energy distribution width for the plasma beam. At this time, the examiner additionally notes that while the specification provide support for either interpretation of the "distribution" language (especially considering figures such as figures 2-3), the claims themselves do **not necessitate** the stream is a plasma stream as in [0060], hence are inclusive of ion beams or plasma beams; **nor** do the claims necessitate the distribution being claimed is the width of the energy distribution or the width of the weight distribution, thus arguments directed to energy & weight distributions that are limited to the distribution range/width, as opposed to the distribution location, can not be considered to necessarily remove Baldwin et al. as a rejection (aside from the above consideration of whether or not choice of acetylene would have been expected to make any difference in energy distributions for Baldwin

et al.'s teachings), since it appears that either interpretation of the claim language is consistent with the disclosure, thus either may be considered with respect to a reference, such as Baldwin et al.

To reiterate, **Baldwin et al.** (5,616,179) teach an end-Hall ion source, with a straight path from source to substrate (figures 1 & 2), the teachings therein (see also citation by applicants on page 9 of their 6/1/2006 response) on col. 3, line 65-col. 4, line 12 and col. 6, lines 31- 52, indicate that most species emitted by the end-Hall ion source will traverse the distance from the source to the substrate, without making any gas phase collisions involving subsequent energy loss. While it is indicated on col. 6 that **when methane** gas is used, all the ion species are not carbon containing and some H^+ & H_2^+ will be produced, as seen on col. 4, lines 13-23, methane is **not** the only hydrocarbon contemplated for use by Baldwin et al., **but alternate hydrocarbons**, such as **acetylene** are also contemplated. From Baldwin et al.'s comments, it appears expected that "all the ion current was assumed to be **carbon containing**" (emphasis added) for such alternatives, thus would **inherently have a narrower & more uniform ion species distribution** when using alternative explicitly taught gases, such as **acetylene**, due to compositional & energetic considerations, such as its inherent well-defined reaction path. Note that Baldwin et al.'s teachings when discussing most species emitted from their ion source that are arriving at the substrate, are including neutral species, nonionized radicals, etc., as being important to the formation of their a-C:H deposition, however applicants' claims while **limiting parameters** concerning the **ions** in the stream from the plasma, do **not exclude** the presence of these neutral species, etc., since they are not ions, but may come from a plasma. While Baldwin et al. indicates that the various neutral species are important in the formation of the deposit, the teachings **also indicate** that the **positive ion hydrocarbon species** are also **important**, hence they must be said to promote the formation of the taught a-C:H deposition (as well as DLC (abstract)), which is the material being deposited. Applicants' claims do not prohibit or exclude other influences from contributing to the formation of the claimed sp^3 C-C bonds, they merely require energizing the **ions** to form a stream, where "the substantially uniform **impact** energy

distribution and the substantially uniform weight distributions **promote** formation" thereof (or the like; emphasis added), which the process of Baldwin et al. also unquestionably does. It would appear from the teachings of Baldwin et al. that when hydrocarbons, such as the taught **acetylene**, which can be assumed to **have all ion species being carbon-containing** as taught, that they would **correspond** to a **substantially uniform weight distribution** as claimed (lacking any actual clear evidence to the contrary for taught acetylene) and would have been affecting, hence promoting formation of sp^3 carbon-carbon bonds. Note: col. 1, line 62-col. 2, line 17 discussing the presence of sp^3 in deposits & col. 2, lines 66-67+ stating "A primary object of the present invention is to provide a process for depositing diamondlike carbon films...", where the examiner takes notice that by definition DLC films will have percentages of sp^3 C-C bonds as claimed.

(Note the mentioned "broad beam" irradiation previously cited by applicants in col. 9, is an <u>optionally</u> supplied ion source using Ar + N_2, that is <u>not</u> the carbon ion source & used in an alternate mode process, hence is not relevant to the discussion.)

With respect to Baldwin et al.'s important feature of "2. The ranging energy distribution of the hydrocarbon-based positive ions in the beam", this statement does not tell what is meant by "ranging energy distribution", hence must be read in light of the rest of the disclosure in the patent, such as col. 4, line 53 that states "the ion beam energy is **about 100 eV**" (emphasis added), or col. 5, lines 17-34 teaching "it is believed that when the **average energy per deposition carbon atom is about 100 eV**, then hard, substantially optical transparent electrically resistive and non-electron-emissive a-C:H is produced. When the average energy per deposited carbon atom is **about 50 eV**, then softer...a-C:H is produced.... One reason that V_{anode} values must be higher than expected is that there is a **particular range** of ion energies produced at any given V and that there are <u>low energy</u>, reacted <u>neutral</u> species present as well..." (emphasis added), hence it is apparent from these teachings that by choosing a **particular energy** in a range of energies for the positive ions one produces a-C:H depositions with different hardnesses, i.e.

different sp^3 carbon-carbon bond percentages, where these **energy distributions centered** around the exemplary 100 eV energies for the deposited carbon atoms, i.e. impact energies, **clearly are promoting** the claimed bond structures and appear to be **sufficiently uniform within the context claimed**, with clear teachings concerning use of energy to achieve different hardness properties, especially considering discussions of using like precursors & like peak energy values as discussed by applicants to produce the hard a-C:H films. As previously noted, at taught energies, **ion implanting** mechanisms would have been expected to be involved during the **coating** process, especially as the thickness of the coating increased, such that there is ion mixing at the interface, along with the coating, hence this appears consistent with applicants' claimed **subplantation**.

With respect to the specifically claimed width of the energy distribution being "approximately 5% of a bias voltage", it is noted that average energy is related to Baldwin et al.'s V_{anode}, hence may be considered related to some sort of bias voltage, although the percentage cannot be determined from the given information, & cannot be measured by the PTO, however given taught use of anode voltages (i.e. ≡ bias voltages) to control film properties with the use of energies suggestive of those claimed & used with the suggested acetylene as the source gas, like energy distributions would have been expected, as acetylene has a limited number of ion species that would be produced, thus available to be accelerated by their charge with respect to the anode voltage & defined by that voltage. With respect to the claim of "a dominant species of carbon ion and a non-dominant species of carbon ion", there will inherently be in any plasma, species that have higher percentages (i.e. can be called dominant species) and those with lower percentages, and at least some or one of the carbon ion species of Baldwin et al.'s plasmas, such as those employing the suggested acetylene, would reasonably have been expected to be at or below 5%. Note that the "comprises" language with respect to ionic species does not limit how many non-dominant species are present, such that these claims are not considered to distinguish over Baldwin et al, including newly (unsupported) ≥ 95 % C_2 ionic

components with acetylene usage, especially considering taught use of the same acetylene source gas & that only the ion species present in the stream are being limited & defined.

Applicants' point (page 9 of 6/1/2006 response) about Baldwin et al.'s use of hydrogen to prevent formation of graphite like carbon bonds, is not considered to effect the relevance of the Baldwin et al. reference, because applicants' claims do not exclude the use of hydrogen or the effects thereof taught in Baldwin et al., particularly noting applicants' paragraph [0016], which includes the presence of hydrogen in the ion stream or the deposited coating. Furthermore, Baldwin et al. has input of hydrogen gas into the chamber (not into the ion source) for their use in preventing graphite-like chemical bonds (col. 9, lines 53-56), thus is not affecting the emissions from the ion stream, hence is neither included nor excluded by applicants' claim language.

While Baldwin et al. does not teach a particular percentage of sp^3 carbon-carbon bonds in their deposits, they do teach that a-C:H deposits contain sp^3 hybridization (col. 1, lines 58-col. 2, line 17, especially 5-10), and means of using the ion energy to effect the hardness, which one of ordinary skill in the art would recognize is affecting the percentage of sp^3 hybridization. Therefore, it would have been obvious to one of ordinary skill in the art to adjust their average ion energy in order to produce the hardness desired for the particular end use, where higher energies that are said to produce the harder films would have been expected to have had higher percentages of sp^3 hybridization, where routine experimentation would have reasonably been expected to determine the energy to promote the desired degree of hardness/percentage of sp^3 hybridization especially given taught consideration thereof, and thus would have been expected to encompass claimed values.

Note that Baldwin et al. teach that deposition rate (col. 5, lines 5-13) varies with distance between source and substrate providing examples above a deposition rate of 2000 Å/min (= 33 Å/sec) at a few centimeters distance with 500 Å /min (≈8.3 Å /sec).

As Baldwin et al. provide no spectra, i.e. no Raman spectra, or any other spectra, the examiner cannot directly evaluate whether or not peaks, as in claims 29-30 & 39-40, are or would have been produced, however as [0102] in the specification appears to indicate that a Raman spectra G-peak is related to the percentage of C-C sp^3 content of the film, it appears that G-peaks in the claimed range of 1490-1510 cm^{-1} would have been expected to be present **due to the presence of taught sp^3 hybridization** as discussed above, especially considering discussions of producing hard a-C:H or DLC films, which necessitate the presence of the bond structures apparently required to create these peaks. The plasmon peak is discussed in the same paragraph, however the examiner cannot determine from the information given, exactly how it relates to density of the deposit, plasma deposition techniques, etc. (see above sections 4-5), however given the taught DLC & hard a-C:H films deposited, it would appear that plasmon peak values would have been expected to significantly encompass densities expected from Baldwin et al.'s deposits, especially when made from taught acetylene source gas, which probably, as near as can be determined from the lack of information on the meaning of the plasmon peaks, would correspond to plasmon values as claimed.

As previously set forth with respect to Baldwin et al. (179), applicants' 6/18/07 arguments & their previous citation of col. 5, lines 55-56 & col. 6, lines 3-8 as their sole reason for alleging Baldwin et al. teaches against applicants' claimed uniform impact energy distribution & substantially uniform weight distribution, the teachings of Baldwin et al. were previously re-reviewed with respect to this generic statement of advantage, however no other recitations with respect to the presence of any low[er] energy **ions** was found. Although more detailed description with respect low energy **reactive neutral species** was found, thus with all due consideration, the examiner must give more weight to the more detailed & explicit parts of Baldwin et al.'s disclosure, which provided the source of the various contributing components & described the lower energy component of the deposit that provides advantages to the deposition techniques as "...low energy, reactive neutral species... these low energy

species reduced the average energy per carbon atom deposited..." (col. 5, lines 28-34), without any mention of ions as the low energy component (col. 6, lines 41-52 that discusses carbon[...neutral...species] deposited from over and above the carbon from the ion flux, & Baldwin et al.'s claims 29-32 that defined the ion energy with respect to the anode voltage, were also germane to the discussion of higher energy ions & lower energy neutral species), especially when one considers the reaction paths available with respect to Baldwin et al.'s suggested hydrocarbon source gas, **acetylene**, which would have been expected to be even more restricted due to its available reaction paths, than their preferred & exemplified methane source. This would appear to be an appropriate assessment when reviewing the "best mode" discussion on col.s 7-8, where the application of a single anode voltage does not appear to provide any means for producing an ion energy distribution containing both high energy ions & low energy ions, which applicants previously asserted is required in Baldwin et al., but the "best mode" teaching would appear to be entirely consistent with ion energy supplied and defined by the anode voltage, with lower energy components being deposited coming from the neutralized activated species that are traveling with the ions in the Hall on ion source output, but are not themselves ions (hence are not excluded by applicants' claim language), & as the neutralized species are not being accelerated due to their lack of charge, they would be at a lower energy.

Applicants' previous (5/12/2008) arguments with respect to Baldwin's teaching, such as found on col. 6, lines 3-8, appeared relevant to Baldwin's preferred teachings of exemplary source gases such as methane, but it did not appear that such split low & high ion distributions would be appropriately or reasonably applied to Baldwin suggested use of the acetylene. The examiner noted that experimental evidence presented commensurate scope with claim limitations might be presented to show whether or not applicants are warranted in their blanket application of select teachings in Baldwin et al. to all alternative gas sources, especially taught use of acetylene, as suggested in Baldwin et al. Thus, questions remain, such as can applicants provide any evidence on why the particularly defined ion energies with

respect to the anode voltages would include both high & low energy components, as opposed to the more detailed descriptions breaking down of Hall ion source outputs as being **ion** energies produced at a given voltage (high energy component) combined with <u>low energy</u> reactive **neutral** species (<u>low energy component</u>), especially when employing the <u>suggested</u> acetylene gas, which would inherently have a narrower weight distribution of ions due to its inherent reaction paths than other hydrocarbon gases? Or would applicants have any support for eliminating the contribution of neutral (lower energy) species to the deposition, which would differentiate from Baldwin et al.'s technique as described in detail?

6. **Claims 19, 31-35 & 39-40** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Baldwin et al.** as applied to claims 3-5, 16-17, 20, 23-30 & 37-38 above, and further in view of **Rabalais et al.** (5,374,318, previously discussed in sections 8-11 & 8 & 8 of the action mailed 3/29/2005 & 7/21/06 & 9/6/07, respectively).

While Baldwin et al. discusses desirable hard coating & optical properties of their diamondlike carbon deposits, they do not teach coating on a magnetic recording media, however as previously discussed, the secondary reference of Rabalais et al. discusses the usefulness of such carbon deposits for optical coatings or protective coatings on magnetic recording media, etc. (col. 1, lines 19-48), thus motivating the specifically claimed enduse, as Rabalais et al. shows the desirability of properties as are produced in Baldwin et al. used on such substrates.

7. **Claims 19, 31-33 & 39** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Markunas et al.** as applied to claims 3-4, 20, 23-24, 28-29 above, and further in view of **Rabalais et al.** (5,374,318).

Markunas et al.'s process is discussed with respect to use in semiconductor processing, but does not discuss use for protective purposes, such as is commonly employed a magnetic recording medium, however **Rabalais et al.**, as previously discussed (see above) teaches the use of such coating materials for protective purposes, including specific mention of magnetic recording media, but also notes that diamond

films or diamond-like carbon (DLC) have applications for semiconductor processing (abstract; col. 1, lines 14-47+, esp.15, 42 & 44), hence it would have been obvious to one of ordinary skill in the art to employ carbon coatings as taught by Markunas et al. in other enduses as suggested by Rabalais et al., inclusive of protective coatings for magnetic recording media, with a reasonable expectation of effective results.

8. **Claims 3, 16, 20, 23-24 & 28-29** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Kirchner et al.** (5,811,820).

Claims 19-20, 31-33 & 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kirchner et al. as applied to claims 3, 16, 20, 23-24, 28-29 above, and further in view of Rabalais et al. (5,374,318).

It is noted that **Kirschner et al.**'s filing date is between the filing date at applicants' original divisional parent & their provisional documents, however Kirschner et al. also has a provisional application, whose filing date is before applicants' provisional filing date, however none of the provisional documents are scanned, hence are not at this time available to the examiner, however she has attempted to order them for future review, but only Kirchner et al.'s provisional documents order was excepted by the computer (but not yet received).

Kirchner et al. teach an ion beam generation process, that may use external ion sources, such as an ECR plasma as a source of ions, which may be used for thin film deposition (or ion implantation), where their process produces a flow of ions, which may flow in a direct line from the plasma chamber to the deposition substrate. Charged species from the plasma exit the ion source through the ion processing unit, where the mass of the ions is selected in the ion conducting channel (e.g. C^+), with ion energy, both the kinetic & internal energy of the ion, controlled by the process, and with teachings concerning narrow energy distributions & mass specified, such that all extraneous contaminating species are absent, with homogeneous & uniform distributions of selected mass ions created over surfaces, such as semiconductor

wafers. While the teachings are mostly generic, mention is made of processes depositing thin diamond films were internal energy control is an essential parameter & CO is used as a source gas for creating C^+, with mention of known deposition of DLC films using C^+100 eV ion beams. Known applications are mentioned to be inclusive of semiconductive diamond based electronics. In Kirchner et al., particularly see the abstract; figures 2, 14-17& 19-20; col. 1, lines 9-40; col. 2, lines 5-47; col. 3, lines 4-25 & 55-58; col. 5, lines 12-13 & 43-54; col. 7, lines 48-68; col. 15, line 34-col. 16, line 64, esp. col. 15, lines 45-62; col. 17, lines 23-43 & 58-68; col. 18, lines 30-63 & and col. 19, lines 5-41.

While Kirchner et al. discussed producing a C^+ ion beam from a plasma source, with their teaching suggesting the ion stream of this ion beam has the weight distribution characteristics required in the present claims, they do not provide a specific example of depositing diamond or DLC films using this taught & suggested beam, however from their teachings which suggest making such films & provide discussion of previous films & parameters used therewith (100 eV, etc.), it would've been obvious to one of ordinary skill in the art to consider the known successful parameters for such depositions & employ them as a basis for routine experimentation for employing the Kirchner et al. process, thus determining particular effective parameters to create the specific desired microstructure which reasonably would have been expected to have employed energies on the order of the known 100 eV C^+ beam. It is noted that diamond & DLC coatings inherently include significant portions of sp^3 C-C bonds, where pure diamond would approach all sp^3 C-C bonds, noting that as applicants' preamble description "amorphous" is not required in the body of the claim, so crystalline diamond deposits are included by the claim process. However, it is noted that diamond-like carbon (DLC) are considered by the PTO to be an art recognized term, where DLC films encompass structures that are generally amorphous through very small crystals (e.g. up to 20 nm in diameter), with carbon gram-atom number densities on the order of >0.2 g-atoms/cc, with properties very close to diamond due to significant proportion of sp^3 C-C bond structure, thus as one of ordinary skill in the art would from the teachings of Kirchner et al. have reasonably expected to be able

to deposit DLC or diamond films via their techniques, via routine experimentation with respect to essential parameters, such as the mentioned energy, this suggests microstructure of depositions ranging from amorphous to crystalline & significant, but lower concentrations of sp^3 C-C bond structure up to that required for pure diamond, hence even if applicants' preambles for the independent claims were properly associated to require "a coating comprising a continuous tetrahedral amorphous carbon", these teachings would be considered inclusive of suggesting such depositions, especially since "comprising" means it need not be purely amorphous sp^3 C-C bond structure.

With respect to use of semiconductor substrates, while Kirchner et al. suggest their process as useful on 12 inch semiconductor wafers, they do not specifically teach deposition of diamond or DLC on such substrates, however they do note that conventional applications for such films include semiconductive diamond-based electronics, or optical coatings, insulators, conductors, abrasives and lubricants, hence use of Kirchner et al.'s techniques in semiconductor processing is considered suggested such that it would've been obvious to one of ordinary skill in the art to do so. While the mentioned applications for thin films do not specify use on magnetic recording media substrates, the overlap of uses with those as suggested by Rabalais et al., who does suggest use on magnetic recording mediums, would've suggested to one of ordinary skill the art the obviousness of such an enduse for protective coatings for magnetic recording material.

9. **Claims 3-5, 16-17, 19-20, 23-25, 28-29, 31-33, 35 & 39** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 & 8-9, or claims 1-3 & 9, or claims 1-2, 5, 7 & 11, or claims 1-27, or claims 1-3, 5, 7, 12-14, 16 & 21-24, or claims 1 & 14-26, or claims 1-3 & 7-8 of U.S. Patent No. **6,793,979 B2**, or **6491987 B2**, or **7,033,649 B2**, or **6,878,404 B2**, or **6,638,570 B2**, or **6,475,573 B1**, or **6,395,323 B2**, respectively, in view of **Baldwin et al.** (discussed above), further in view of **Rabalais et al.** for claims 19-20, 31-33, 35 & 39.

Claims 3, 16, 19-20, 23-24, 28-29, 31-33 & 39 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 & 8-9, or claims 1-3 & 9, or claims 1-2, 5, 7 & 11, or claims 1-27, or claims 1-3, 5, 7, 12-14, 16 & 21-24, or claims 1 & 14-26, or claims 1-3 & 7-8 of U.S. Patent No. **6,793,979 B2**, or **6491987 B2**, or **7,033,649 B2**, or **6,878,404 B2**, or **6,638,570 B2**, or **6,475,573 B1**, or **6,395,323 B2**, respectively, in view of **Kirchner et al.** (discussed above), further in view of **Rabalais et al.** for claims 19-20, 31-33 & 39.

Claims 3-4, 19-20, 23-24, 28-29, 31-33 & 39 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 & 8-9, or claims 1-3 & 9, or claims 1-2, 5, 7 & 11, or claims 1-27, or claims 1-3, 5, 7, 12-14, 16 & 21-24, or claims 1 & 14-26, or claims 1-3 & 7-8 of U.S. Patent No. **6,793,979 B2**, or **6491987 B2**, or **7,033,649 B2**, or **6,878,404 B2**, or **6,638,570 B2**, or **6,475,573 B1**, or **6,395,323 B2**, respectively, in view of **Markunas et al.** (discussed above), further in view of **Rabalais et al.** for claims 19-20, 31-33 & 39.

On these patents have claims directed to methods of depositing DLC or diamon-dlike carbon having sp^3 bonding as claimed, where the deposition techniques at some point in the claims is required to be ion beam deposition, thus it would've been obvious to one of ordinary skill in the art to employ no ion beam deposition techniques capable of depositing such claim materials, which would've been inclusive of techniques as taught in Baldwin et al. or Kirchner et al. or Markunas et al., further considering Rabalais et al. for specific use as protective coatings for magnetic recording media, particularly considering above discussion of these references.

11. **Other art** of interest includes: **Baum et al.** (5,525,392) who creates an RF plasma in an ionization chamber using a carbon containing gas source, and extracts an ion beam therefrom with teachings that ions at an ion beam are generally mono energetic having a narrow energy distribution of about ± 10%... more preferably about ± 2 %, however their process is directed to polymeric coating depositions. **Tompa** (5,650,201) discloses use of a C^- ion beam source, such as may be provided by the

techniques of Kim (5,466,941), which preferably has an energy adjusted in the range of 50-200 eV, with a narrow energy distribution of several eV, which may be used to deposit diamond films (col. 4, lines 20-54 & col. 5, lines 16-25), however the ion beam formation techniques cited uses ion beam sputtering, rather than plasma sputtering as the initial source. Schmitt et al. ((5,266,409): abstract; figures for & 9; tables II & III; col. 14), provides additional teachings concerning alternative use of RF plasma or a "primary ion beam" (e.g. an ion gun implying a mixture of methane & Ar to create ionized particles at ~30-200 eV), which may be used for DLC or amorphous hard carbon deposits, but fails to give sufficient details to enable determined relationship of their ion beam techniques to the claimed deposition technique. The Japanese reference to Ogata et al. (JP 63-206930)'s English abstract discloses a uniform low energy ion beam having a large beam area, made from a "bucket-type" ion source employing methane gas, but the abstract does not provide discussion of the ion weight distribution.

Also of interest for DLC deposition using techniques of interest, but not prior art are **Pern et al.** (7,459,188 B2) & **Grannen et al.** (6,392,244 B1).

Leung (5,517,084) & Ono et al. (4,450,031), cited by applicants, are noted to be directed to remote plasma techniques that extract selected ions as desired, directed straight towards the substrate, but do not discuss their processes with respect to carbon ion sources, nor tetrahedral amorphous carbon or DLC deposition.

12. Applicant's arguments filed 12/9/2008, & discussed above have been fully considered but they are not persuasive.

13. **Any inquiry** concerning this communication or earlier communications from the examiner should be directed to **Marianne L. Padgett** whose telephone number is (571) 272-1425. The examiner can normally be reached on M-F from about 9:00 a.m. to 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Marianne L. Padgett/
Primary Examiner, Art Unit 1792

MLP/dictation software

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